

## Message Text

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FOR SCICOUN

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SUBJECT:CONTROLLED THERMONUCLEAR RESEARCH 07.03.00

1. REQUEST EMBASSY DELIVER FOLLOWING MESSAGE TO ORGANIZING  
COMMITTEE OF THE SEMINAR ON THE APPLIED PROBLEMS OF LOW  
TEMPERATURE MATERIALS AND THE MANUFACTURE OF WELDED CRYO-  
GENIC STRUCTURE:  
E.O. PATON WELDING INSTITUTE  
BOZHENKO 11  
KIEVE 5, U.S.S.R.

2. GENTLEMEN:  
DR. E.N.C. DALDER OF THE DIVISION OF MAGNETIC FUSION  
ENERGY, US ERDA, GRATEFULLY ACCEPTS YOUR INVITATION TO  
PARTICIPATE IN THE SUBJECT SEMINAR AND THE ASSOCIATED USSR-  
US COOPERATION ON ELECTROMETALLURGY. HE WILL PRESENT A  
PAPER ENTITLED "STRUCTURAL MATERIALS, DESIGN CRITERIA AND  
FABRICATION METHODS FOR SUPERCONDUCTING ENERGY STORAGE  
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SYSTEMS; A STATUS REPORT". A COPY OF AN ABSTRACT OF THE

PAPER FOLLOWS.

3. THANK YOU FOR YOUR INVITATION.

- - - - - CORDIALLY YOURS,

STRUCTURAL MATERIALS, DESIGN CRITERIA, AND  
FABRICATION METHODS FOR SUPERCONDUCTING ENERGY STORAGE  
SYSTEMS; A STATUS REPORT

EDWARD N.C. DALDER  
DIVISION OF MAGNETIC FUSION ENERGY  
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRA-  
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#### ABSTRACT

THIS PAPER ADDRESSES THE RELATED AREAS OF SELECTION,  
DEVELOPMENT AND FABRICATION OF STRUCTURAL MATERIALS FOR  
LARGE SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEMS FOR  
USE IN THE MAGNETIC FUSION ENERGY--MFE-- PROGRAM OF THE  
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION.

A REVIEW OF THE MFE NEEDS FOR SUPERCONDUCTING MAGNET  
STRUCTURES IS PRESENTED TOGETHER WITH AN EXTENSIVE ANALY-  
SIS OF STRUCTURAL DESIGN CRITERIA. FOLLOWING THIS, A  
REVIEW OF AVAILABLE STRUCTURAL ALLOYS SUCH AS THE SIMPLE  
AUSTENITIC STAINLESS STEELS, NITROGEN-STRENGTHENED  
STAINLESS STEELS, SOLID SOLUTION STRENGTHENED NI-CR-FE  
ALLOYS, PRECIPITATED-STRENGTHENED NI-CR-FE ALLOYS,  
ALUMINUM ALLOYS, AND HIGH PURITY TITANIUM ALLOYS IS  
PRESENTED. AVAILABLE MATERIALS-PROPERTY DATA IN THESE  
ALLOY CLASSES ARE COMPARED, WITH EMPHASIS ON THE EFFECTS  
OF LOW TEMPERATURE ON ELASTIC MODULUS AND YIELD STRENGTH,  
FATIGUE PERFORMANCE, AND VARIOUS FRACTURE-CONTROL  
CRITERIA, SUCH AS PLANE-STRAIN FRACTURE-TOUGHNESS, AND  
CRACK-GROWTH RATE. CONCLUSIONS ARE DRAWN RELATIVE TO THE  
NEED FOR ADDITIONAL DATA-GENERATION AND THE MOST PROMIS-  
ING MATERIAL-CLASSES FOR FURTHER INVESTIGATION.

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THE IMPORTANT AREAS OF FABRICATION OF THESE MATERIAL  
CLASSES ARE REVIEWED. SUCH JOINING-RELATED PROBLEMS AS  
WELDING OF HEAVY SECTION COMPONENTS, CONTROL OF  
FERROMAGNETIC PHASES IN AUSTENITIC STAINLESS STEEL  
WELDMENTS TO MINIMIZE MAGNETIC FIELD PERTURBATIONS,  
OPTIMIZATION OF WELDING PRACTICE TO AVOID EMBRITTLEMENT  
PROBLEMS COMMON TO NI-CR-FE ALLOYS, SUCH AS HOT CRACKING  
AND STRAIN AGE CRACKING, AND THOSE COMMON TO TITANIUM

ALLOYS, SUCH AS HYDROGEN EMBRITTLEMENT, ARE DISCUSSED  
IN DETAIL. ALSO TREATED IS THE EFFECT OF PRIMARY  
PROCESSING TECHNIQUES, SUCH AS AIR-MELTING, ELECTROSLAG  
REMELTING, AND VARIOUS VACUUM MELTING PROCEDURES, ON  
THE RESULTING MECHANICAL AND METALLURGICAL PERFORMANCE  
OF NI-CR-FE AND TI ALLOYS. THE FINAL TOPIC TO BE  
PRESENTED IS A DISCUSSION OF CURRENT PLANS FOR SUPER-  
CONDUCTING MAGNETIC-ENERGY STORAGE SYSTEMS, IN LIGHT  
OF PREVIOUSLY IDENTIFIED NEEDS AND THE PRESENT STATUS  
OF MATERIALS AND FABRICATION METHODS. KISSINGER

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